Allogeneic Umbilical Cord Derived-Mesenchymal Stem Cell (UC-MSC) treatment in a Chronic Case of Traumatic Brain Injury: A Case Report

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1. Background

Traumatic Brain Injury (**TBI**) can be defined as impaired brain function induced by an external force. **In current treatment**, there are no ability to preserve or improve brain function. Recently in **regenerative medicine, Mesenchymal Stem Cell** (**MSC**)-**based therapy** has been recently getting attention due to their therapeutic capabilities such as secretion of **neurotrophic factor, neuroprotective factor, and its regeneration capabilities** to replace damaged neuron cells. This novel intervention as a therapeutic strategy to observe MSC capabilities in ceasing neuronal degeneration and replacing damaged neurons. Various **preclinical studies** have also suggested the **safety, efficacy**, as well as the different abilities of MSC such as multilineage differentiation in **regenerating and replacing damaged cells**, and acting as an **immunomodulator** at the injured site, **reducing inflammation and inflammatory responses.**

2. Methods

A 37-year-old male had TBI, as a victim of violence 3 years later. **MSC transplantation was done right after Ommaya and was done 6 times for approximately every one month after initial transplantation. Allogenic UC-MSC is prepared on 2 syringes filled with $7.5x10^7$ cells in 50 mL NaCl 0.9% and 1 syringe filled with $1x10^6$ cells in 3 mL NaCl 0.9%.** Brain function and structural change was measured using MRI. Further functional measures was done through Glasgow outcome scale (GOSE).

3. Result & Discussion

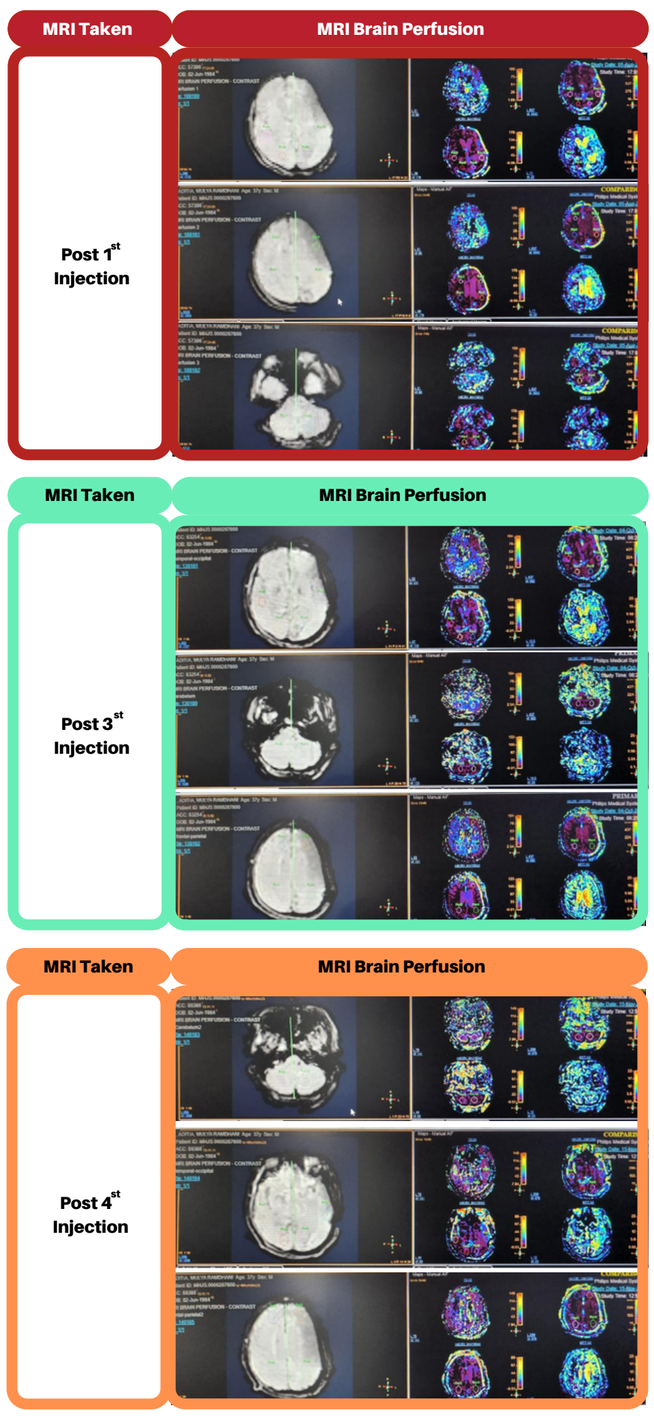
In **MRI diagnosis**, the final month presents similar results from the baseline scans which are **evidence of widening** in cerebral sulci and sylvian fissure indicating brain atrophy, multiple infarcts in left frontal lobe and aged infarcts with gliosis in left temporooccipital lobe, lacunar infarct returns in the left thalamus, bilateral basal ganglia, and left pons, ventriculomegaly with hydrocephalus imaging attached by VP shunt entry point in the left lobe, edge left of intraventricular lateralis, and post op defect in left front temporoparietal region. As for **MRI values changes**, results showed an **indication of decreased** CBF, CBV, and MTT in both left cerebral hemisphere and cerebellum, while the right hemisphere and cerebellum exhibits an **increase** in CBV, CBF, and MTT, in comparison during the fifth and sixth month of injection.

Table 1. MRI value changes of CBF, MTT, and TTP in comparison of fifth and sixth month of injection

DOI	Position	Region	MRI			
			(ml/100g)		(s)	
			CBF	CBV	MTT	TPI
V	Left	Frontal	47,3	9,6	12,2	31,4
		Parietal	24,9	4,8	11,6	36,7
		Occipital	51,5	13,5	15,7	33,2
		Temporal	68,6	24,9	21,8	38,4
		Cerebellum	50,8	13,7	16,2	34,9
	Right	Frontal	22,6	1	2,7	33,2
		Parietal	29,7	3,9	8	34,9
		Occipital	45,1	6	8	34,9
		Temporal	30,1	1,1	2,3	34,9
		Cerebellum	39,1	0,9	1,3	34,9
VI	Left	Frontal	64,1	11,1	10,4	15,5
		Parietal	16,1	2,1	8	38,8
		Occipital	48,9	4,9	6,1	36,2
		Temporal	30,9	4	7,8	23,3
		Cerebellum	29,8	2,6	5,4	38,8
	Right	Frontal	24,8	4,4	10,8	38,8
		Parietal	23,6	3,7	9,3	38,8
		Occipital	53,3	8,2	9,2	36,2
		Temporal	39,4	7,8	12	38,8
		Cerebellum	25,7	3,9	9,1	36,2
Difference	Left	Frontal	16,8	1,5	-1,8	-15,9
		Parietal	-8,8	-2,7	-3,6	2,1
		Occipital	-2,6	-8,6	-9,6	3
		Temporal	-37,7	-20,9	-14	-15,1
		Cerebellum	-21	-11,1	-10,8	3,9
	Right	Frontal	2,2	3,4	8,1	5,6
		Parietal	-6,1	-0,2	1,3	3,9
		Occipital	-8,2	2,2	1,2	1,3
		Temporal	-9,3	6,7	9,7	3,9
		Cerebellum	-13,4	3	7,8	1,3

* Green highlights indicate improvement and red highlights indicate no improvements

CBF: Cerebral blood flow; CBV: Cerebral blood volume; MTT: Mean transit time; TTP: time to peak.



Picture 1. Results of MRI Diagnosis

4. Conclusion

Allogenic UC-MSC transplantation holds a promising future in the management of TBI. Although more data is needed, these preliminary results show the potential to **preserve the viable neurons and replace the damaged** ones by the mechanism of neuroprotection and neuroangiogenesis. **Stem cell transplantation along with neurorehabilitation** plays a pivotal role in the **functional recovery of chronic TBI patients**, thus improving their quality of life. A comparative study of various types of cells and routes of transplantation should be researched in detail.

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